

# AEDC

Arnold Engineering Development Center  
Arnold Air Force Base, Tenn. 37389

An Air Force Materiel Command Test Facility

America's  
Aerospace  
Advantage



*Test Before Flight*

[www.arnold.af.mil](http://www.arnold.af.mil)

## Rocket Development Test Cell J-4

AEDC's Rocket Development Test Cell J-4 provides unmatched testing of liquid propellant rocket engines and solid-propellant rocket motors.

J-4 is a vertical test cell designed for testing the World's largest rocket engines. It was built in the early 1960's to support the Apollo program. The test cell is 48-feet-diameter, 125-feet-tall and provides simulated altitude up to 100,000 feet.

With its large-volume and vertical dehumidification chamber reaching 260 feet below ground level, it can support engines with thrust levels up to 1,500,000 pounds.

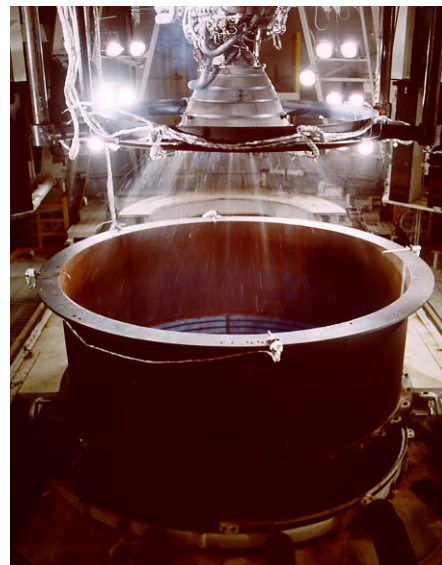
What makes AEDC's J-4 unique is its capability to match altitude pressures during shut down and provide a soft shut down to minimize stress on the nozzle. AEDC's altitude pumping is maintained during the test run and ramped up during the engines entire shutdown event.

No other facility can protect the rocket motor fragile state of the art carbon-carbon nozzles like AEDC's J-4 test stand

with its unique capability to maintain altitude conditions from start to finish.

In 1996, a \$15-million upgrade added new cryogenic and hypergolic propellant system test capabilities. AEDC installed a hypergolic (AZ50/NTO) propellant system which was used to test the Titan IV LR-91 engine and a cryogenic (LOX/LH2) propellant system.

Due to the large size of the facility, J-4 is also uniquely suited to accommodate an extensive suite of state-of-the-art di-



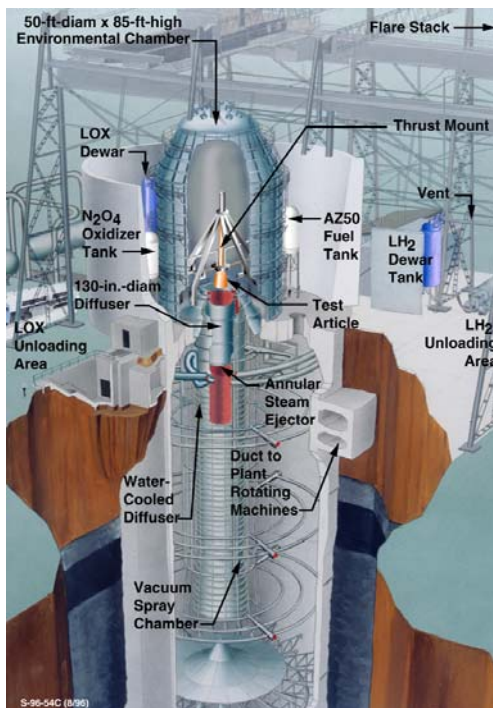
*Rocket Development Test Cell J-4*

characterize plume signature phenomenology and flowfields.

The test cell is equipped with a temperature-conditioning system designed to maintain the test article at a prescribed temperature from 50° to 110°F ( $\pm 5^\circ\text{F}$ ).

The facility is uniquely suited for vehicle integration tests because of its large test cell volume.

J-4 has tested a variety of engines over the years with the most recent being the RL10B2 and the LR-91 (Titan II/III/IV). Others include the LR-87 (Ti-



*Cutaway of J-4 with interchangeable diffuser insert.*

agnostic instrumentation. AEDC has demonstrated these diagnostic tools, which include laser fluorescence, infrared and ultraviolet imagery, high-speed video, and real-time radiography, to verify system performance and structural integrity and

### Test Capabilities of J-4

- Long duration altitude (mission duty cycle) testing
- Testing of high-area-ratio nozzles
- Simulated altitude performance testing
- Ignition performance testing
- Nozzle development testing
- Stage separation tests
- Heat transfer effects and post-test heat soak testing
- Vibration and dynamics testing
- Failure analysis (propellant extinguished) testing
- Vertical spin testing

### Rocket Development Test Cell J-4

- 100,000 feet simulated altitude
- Vertical orientation
- 48 feet diameter x 125 feet high
- 1,500,000 pound thrust capability
- 250,000 data samples/second (aggregate)

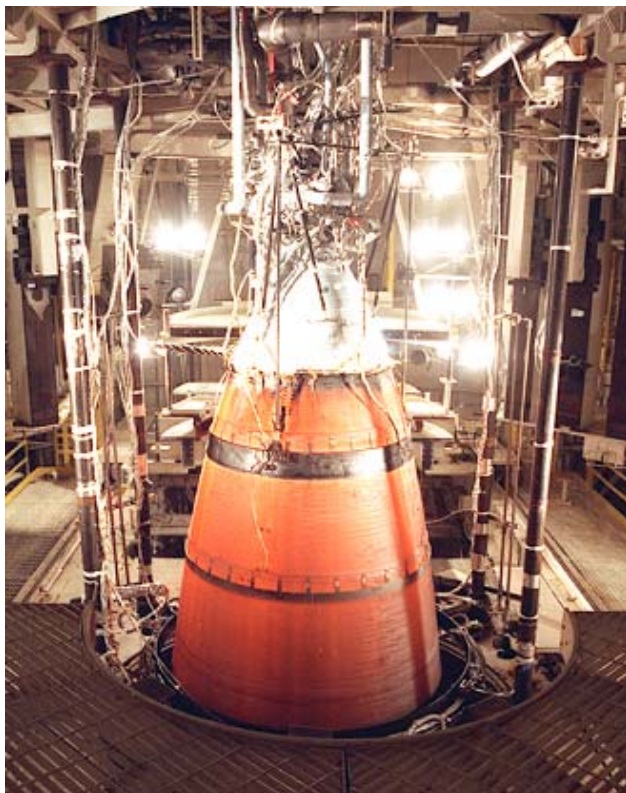
tan IIIC), J2 (Apollo/Saturn), J2S (Post-Apollo), RL 10 (Delta III/IV, EELV), and TR-201 (Delta). Solid propellant motor testing includes Peacekeeper Stage II, Minuteman Stages II and III, Trident Stage III, Super BATES, Small Intercontinental Ballistic Missile Stage II and STAR 27 and 13A motors.

**Key test capabilities:** accurate and repeatable six-component thrust measurement and variable altitude and soft shutdown capabilities to preserve engine hardware. Additional capabilities include providing nozzle gimbal and deployment performance, ignition performance, long duration altitude (mission duty cycle), heat transfer effects and post-test heat soak, failure analysis and vertical spin testing. The test cell digital data acquisition system is designed to acquire up to 500,000 samples per second.

**Upper Stage Testing:** In 1997, J-4 was site selected for the first engine to power a new generation of space launch vehicle upper-stage propulsion systems, the Evolved Expendable Launch Vehicle. Because of its large size and accessibility, J-4 accommodates an extensive range of state-of-the-art diagnostic instrumentation systems to verify system performance and structural integrity and to characterize plume signature phenomenology and flow fields during testing.



*Rocket Development Test Cell J-4*



*RL 10 engine with nozzle extension.*

#### **CONTACT:**

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